Space Weather Technical Forecast

Issued on Monday, 08 November 2021 at 00:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Active Electron Fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar Activity was Very Low with only B-flares observed. There are three active regions on the Earth-facing Sun. AR2893 Hsx/alpha is a mature and stable region just west of centre disc. AR2894 Cro/Beta in the southeast, with the trailer spots now reclassified as a single region due to clear magnetic connection in SDO imagery. A new spot Bxo/Beta is also visible in the northeast, amongst a large area of plage. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind speed, as measured by DSCOVR at L1, eased from elevated levels of 540 km/s to be slightly elevated at 440 km/s, with density generally below average, although a brief peak of 21 ppcc was observed at 07/0040 UTC. The Interplanetary magnetic field (IMF) strength, Bt remained weak, below 6 nT with the north-south component, Bz, weak and mainly positive, varying between +4 nT and -2 nT. Phi angle remained mainly negative (towards the Sun). Geomagnetic activity was generally Quiet with one Active (Kp4) interval 07/0000-0300 UTC.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16, remained at background levels. The high energy electron flux (greater than 2 MeV) was generally rose to be mainly High since 07/0800 UTC peaking 1940 pfu at 07/1545 UTC. The associated 24-hour electron fluence rose to be above the Active (1e8 integrated pfu) from 07/1800 UTC, reaching 1.02e8 integrated pfu at 08/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be Very Low with a chance of rising to Low from any C-class flares.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, although two CMEs passing ahead of the Earth late on the 10th or 11th, whilst expected to miss, have a slight chance of bringing some glancing impact. Current slightly elevated solar winds may also see some limited enhancement for a time day 1 (8th) from the arrival of any fast wind from coronal hole 17. Otherwise solar winds are expected to ease towards background. Geomagnetic activity is forecast to be Quiet with a chance Unsettled intervals, and the potential for Active intervals, mainly day 1 (8th) or day 4 (11th).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at background levels. The high energy electron flux (greater than 2 MeV) will likely see peak values gradually decay through the period, with any arrival of fast wind from CH17 also likely to help flux levels drop out. Active 24 hour electron fluence at first, will likely fall below the Active (1e8 integrated pfu) level through day 1 (8th), with only a decreasing chance of remaining above from day 2 (9th) onward.

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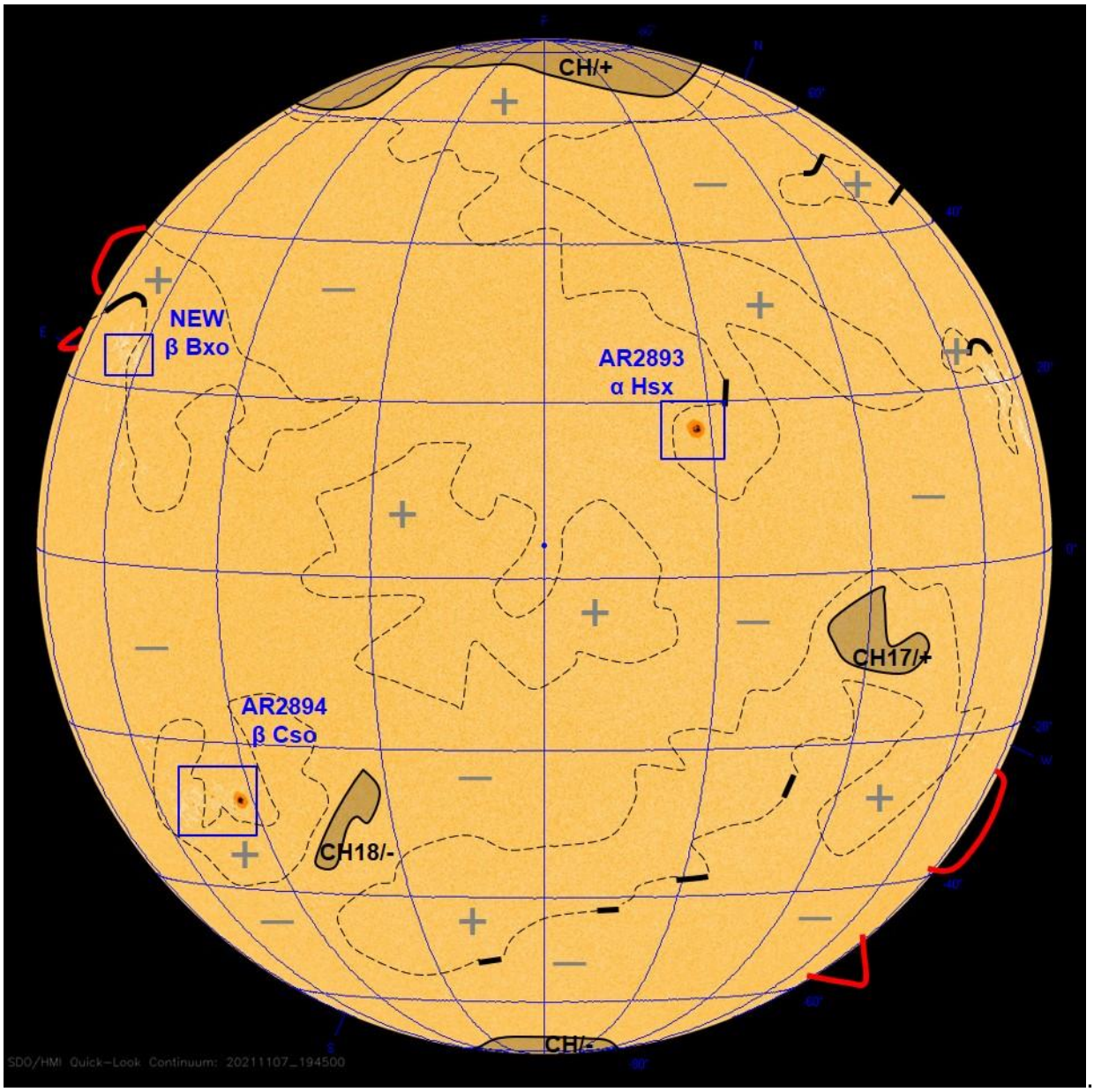
Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs, however a couple of weak CMEs are expected to pass ahead of Earth late day 3 and into day 4 (10th into 11th) with peripheral influences possible, but currently not expected.

Solar winds are currently slightly elevated, and easing after the recent enhancements over the last few days. A further slight enhancement is possible day 1 (8th) as Earth encounters any fast wind from coronal hole 17, which is a small equatorial feature in the west disc. Due to the small, and diminishing size of this feature, any enhancement is low confidence however. Otherwise solar winds are expected to gradually ease towards background.

Geomagnetic activity is forecast to be Quiet with a chance Unsettled intervals, and the potential for Active intervals from any enhancement from either CH17, or from the glancing influence of the passing CMEs on day 4, although these are currently expected to miss.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	1	1	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Current Solar Wind

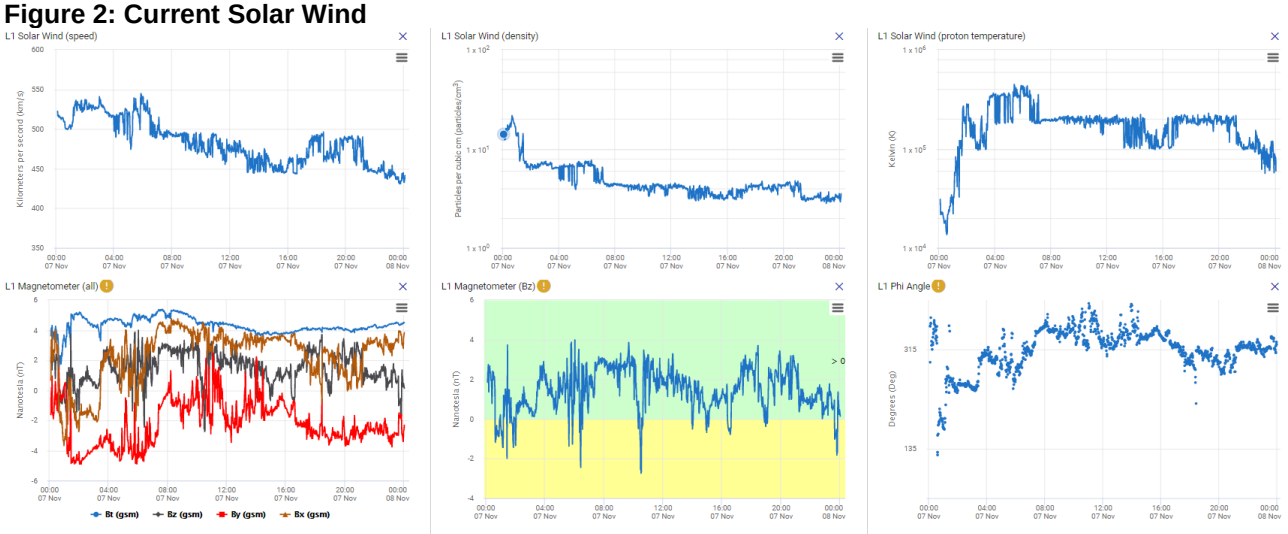

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Figure 3: Enlil - showing weak CMEs passing just ahead of Earth, but with ensemble showing a small chance of a glancing interaction.

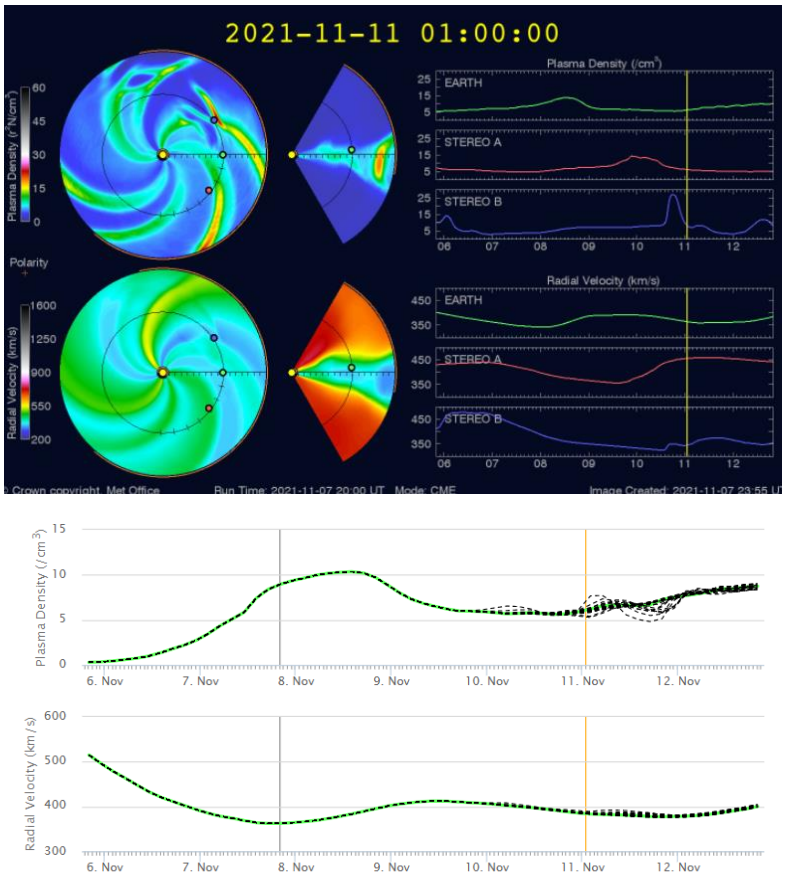
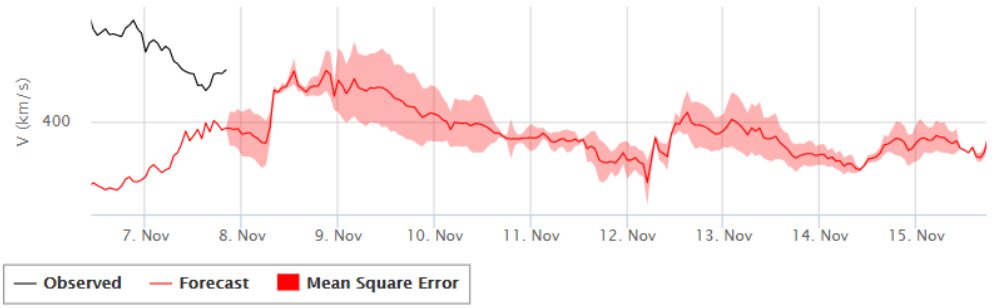


Figure 4: Solar Wind Persistence Model – Showing likely gradual decline of solar wind speed.



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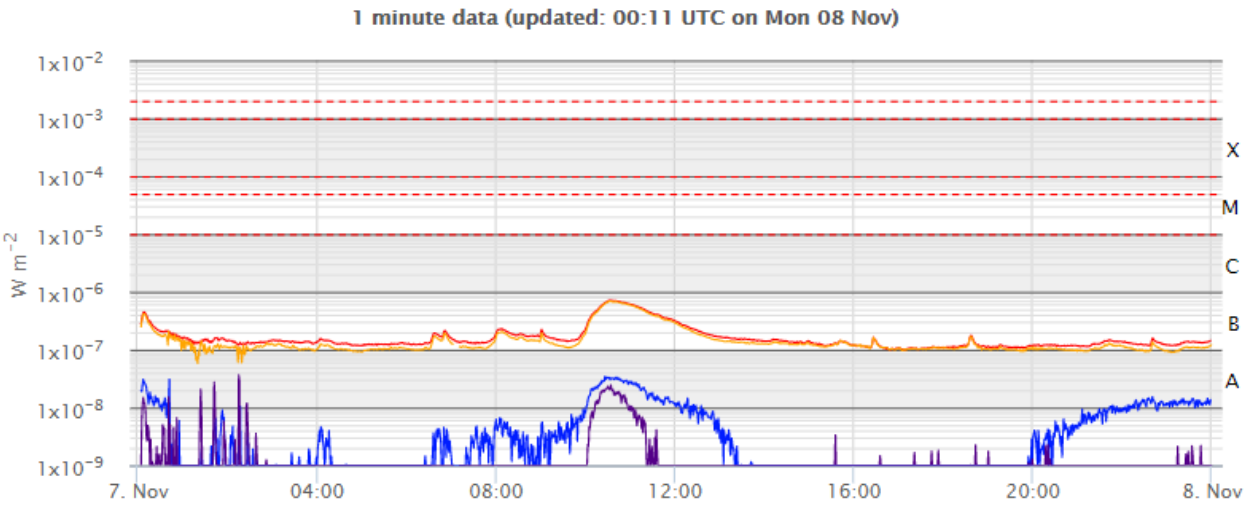
Radio Blackouts - X-Ray Flares:

Solar Activity is currently Very Low with only B-class flares observed in the last 24 hours and three sunspot containing active regions on the visible disc. The most notable sunspot region is AR2894 Cso/Beta, with some emergent spots in a following plage region having now been incorporated into this sunspot, as there is a clear magnetic connection visible on SDO imagery. AR2893 Hsx/alpha remains a stable and relatively small unipolar region. The third region is a new unnumbered Bxo/Beta region amongst plage in the northeast that has become visible as it rotated into a clearer view, is showing little sign of development. There is one other significant plage region in the northwest disc, the site of ex-AR2891, and this is due to soon rotate off the Earth-facing disc.

Consequently Solar activity is expected to remain Very Low with only a chance of rising to Low with any C-flares (30%) and a very slight chance of rising to Moderate.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 5: GOES-16/17 X-ray flux



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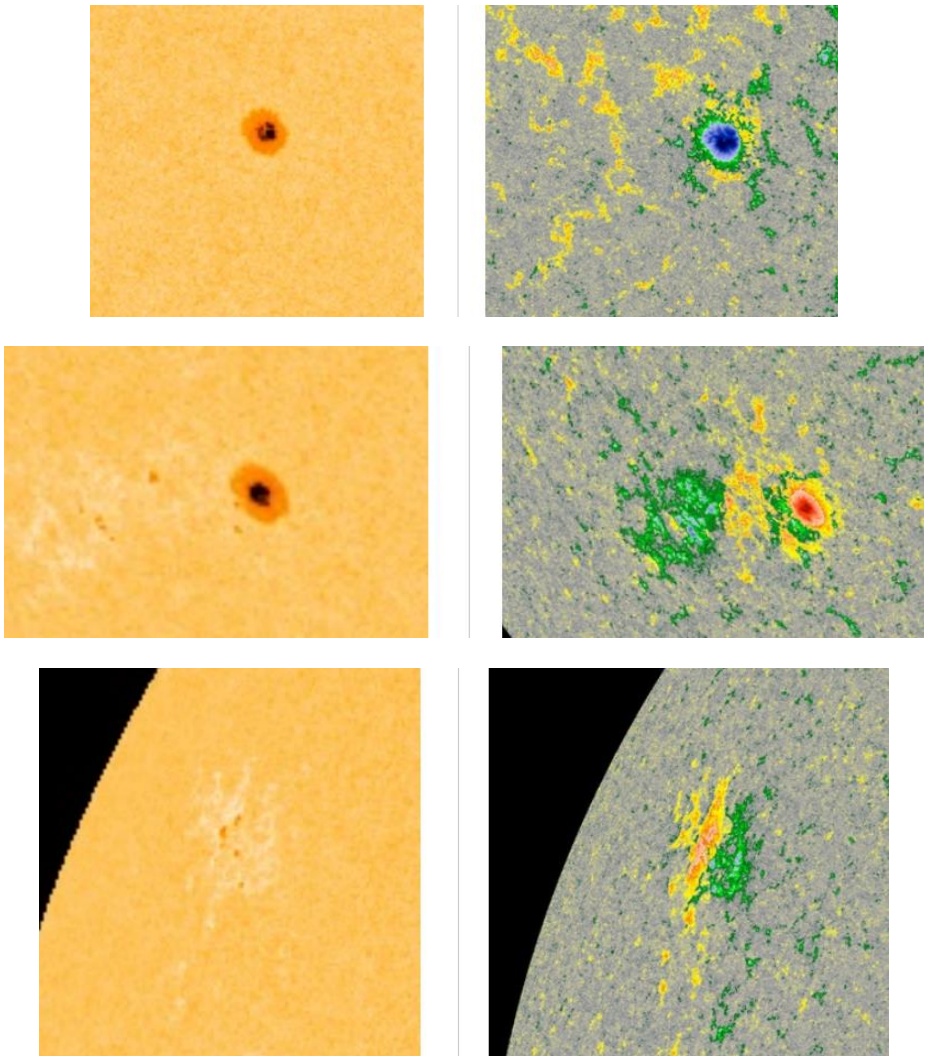
Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is at background levels, and is forecast to remain at these levels through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Figure 6: SDO Intensitygram and Magnetogram of AR2893, AR2894 and new sunspot.



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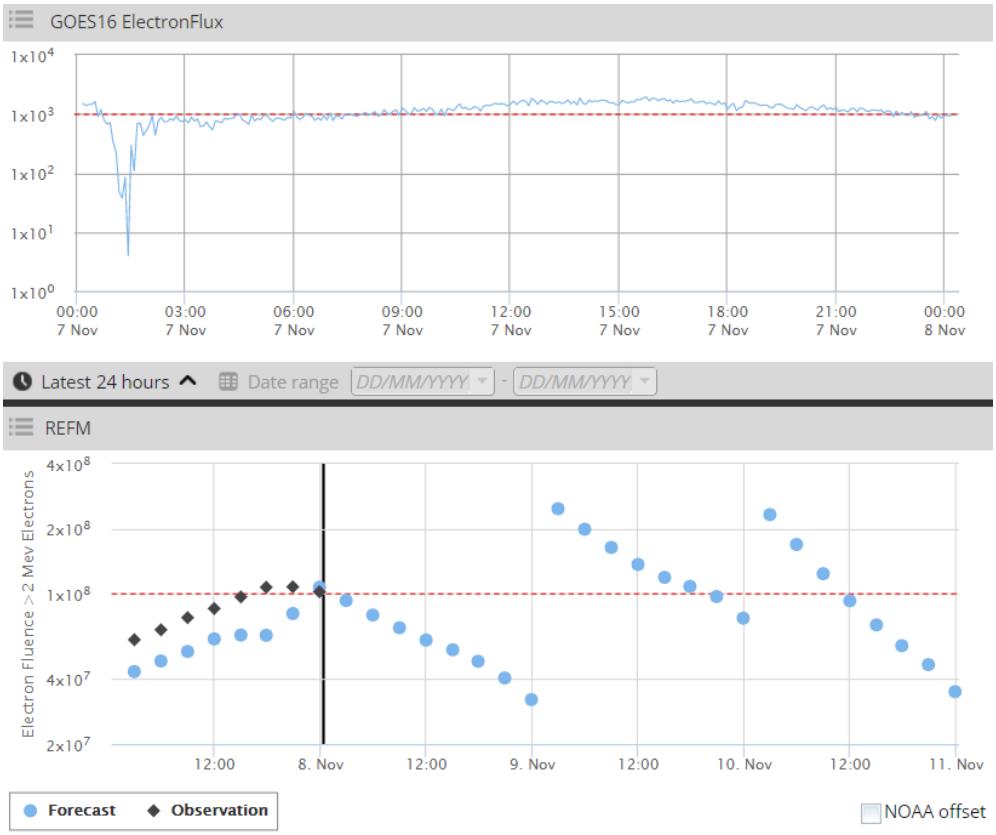
High Energy Electrons Event (≥ 2MeV):

The observed high energy (greater than 2 MeV) electron flux at GEO by GOES-16 is at Moderate to High levels, after the CME arrivals during the previous few days, leading to a period of elevated to strong solar winds. There is the potential for a drop out of values on day 1 (8th), from any geomagnetic activity from the arrival of the weak fast wind from CH17. However this is low confidence. Otherwise, the current high levels are expected to gradually decay, with peak values increasingly likely to be at Moderate levels from day 2 onward (9th)

The associated 24 hour electron fluence is currently Active, but is expected to decline through the period, likely below the Active level by day 2 (9th) onward. This only moderate confidence however, with REFM suggesting fluence levels will be varying around the Active threshold.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	100	40	30	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV electron flux and fluence with REFM



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